



05 - GF - 113
5820

Superior Water Light & Power Company

April 10, 2001



Mr. James D. Looock
Chief Engineer
Electric Division
Public Service Commission of Wisconsin
PO Box 7854
Madison, Wisconsin 53707-7854

Re: Official Filing - Preventative Maintenance Plan

Dear Mr. Looock:

Enclosed are three copies of Superior Water, Light and Power's (SWL&P's) Preventative Maintenance Plan for transmission, distribution, and substation facilities as required by PSC 113.0607. The plan was developed using the plan of the Municipal Electric Utilities of Wisconsin as a guide and was modified as needed to accommodate SWL&P's facilities and practices. Also included is a copy of the cover letter of the electronic version of the plan that was filed on April 6, 2001.

If you have any questions, I can be reached at 715-395-6312 or jkanderson@swlp.com.

Yours truly,

Gerald K. Anderson
Senior Engineer

2915 Hill Avenue, PO Box 519, Superior, WI 54880 • (715) 394-2200

Providing Superior Service

HFC
Elect-2

Jerry Anderson (SWLP)

From: Jerry Anderson (SWLP)
Sent: Friday, April 06, 2001 6:47 AM
To: 'pscsecs@psc.state.wi.us'
Subject: Official Filing: Preventative Maintenance Plan

Official Filing: Preventative Maintenance Plan

Attention: Mr. James Loock
Chief Engineer
Electric Division
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

The first attachment below contains the body of Superior Water, Light, and Power's (SWL&P's) Preventative Maintenance Plan for transmission, distribution, and substation facilities as required by PSC 113.0607. The plan was developed using the plan of the Municipal Electric Utilities of Wisconsin as a guide and was modified as needed to accommodate SWL&P's facilities and practices. The other nine attachments are appendices to the plan.

If you have any questions, I can be reached at 715-395-6312 or jkanderson@swlp.com.

Yours truly

Gerald K. Anderson
Senior Engineer
Superior Water, Light and Power Company
P.O. Box 519
2915 Hill Avenue
Superior, WI 54880



PSC 113.0607
Plan.doc



AppendixA.max



AppendixB.max



AppendixC.max



AppendixD.max



AppendixE.max



AppendixF.max



AppendixG.max



AppendixH.max



AppendixI.max



SUPERIOR WATER, LIGHT, AND POWER COMPANY

PREVENTATIVE MAINTENANCE PLAN

FOR

TRANSMISSION FACILITIES

DISTRIBUTION FACILITIES

SUBSTATION FACILITIES

APRIL 6, 2001

REFERENCE PSC 113.0607

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I. PREVENTATIVE MAINTENANCE PLAN

Wisconsin Administrative Code Chapter PSC 113, Service Rules for Electrical Utilities, was recently completely revised, with that revision taking effect on August 1, 2000. One of the requirements of that document is found in PSC 113.0607, which is entitled "Appropriate inspection and maintenance: system reliability." and reads in part:

"(1) PREVENTATIVE MAINTENANCE PLAN. Each utility or other person subject to this chapter, including persons who own electric generating facilities in this state who provide service to utilities with contracts of 5 years or more, shall develop and have in place its own preventative maintenance plan. This section is applicable to electric generating facilities as set forth at s. 196.491(5)(a)1., Stats. Each plan shall include, among other things, appropriate inspection, maintenance and replacement cycles where applicable for overhead and underground distribution plant, transmission, generation and substation facilities."

This preventative maintenance plan describes the activities of Superior Water, Light and Power (SWL&P) "to ensure high quality, safe and reliable service, considering: cost, geography, weather, applicable codes, national electric industry practices, sound engineering judgement and experience" and is intended to meet the requirements of PSC 113.0607.

II. TRANSMISSION

A. INSPECTION SCHEDULE AND METHODS

The various inspection schedules and methods for transmission facilities are as shown below:

INSPECTION METHOD	UNSCHEDULED	BIANNUAL	1 YEAR	5 YEARS	10-15 YEARS
INFORMAL	X				
AERIAL: HELICOPTER FIXED WING		X X			
GROUNDLINE					
CLIMBING					X
VEGETATION MANAGEMENT			X	X	X

B. GUIDELINES

1. Introduction

SWL&P conducts regularly scheduled aerial patrols, groundline inspections and treatments, and climbing inspections of the overhead electrical transmission system. Informal inspections are conducted in conjunction with other occurrences of construction or maintenance on the system. In general, unusual conditions observed and reported would include, but not be limited to, insufficient clearances between conductor and ground surface or between conductor and other utility crossings, damaged structural components, damaged conductor or conductor suspension components, right-of-way vegetation, and encroachment of other structures or activities on the right-of-way. Data from all inspections is entered in an electronic database.

2. Informal Inspection

Informal inspections are performed by engineering, vegetation management, line department and other utility personnel in route to scheduled maintenance or construction activity on the transmission system. Personnel are instructed to report any unusual condition of the lines or right-of-way to the Minnesota Power Transmission Maintenance Engineer. Emergency conditions are reported directly to the Minnesota Power System Operator. The System Operator will take the appropriate action with regard to temporarily removing facilities from service and will contact line forces to arrange for response.

3. Aerial Inspection

Transmission lines are patrolled using fixed wing aircraft twice per year. A more detailed aerial inspection is performed utilizing a helicopter twice annually.

The fixed wing patrols observe and report on a "by exception" basis. The conditions observed and reported would include, but not be limited to, damaged structural components, major damage to conductor or conductor suspension components, right-of-way vegetation, danger trees, and encroachment of other structures or activities on the right-of-way. Observations are reported to the Minnesota Power Transmission Maintenance Engineer. Emergency conditions are reported directly to the Minnesota Power System Operator. The System Operator will take the appropriate action with regard to temporarily removing facilities from service and will contact line forces to arrange for response. These inspections are conducted by a contracted aviation service. Photographs of major defects or encroachments are taken. Observations are recorded in a hand-written log of the inspection.

Helicopter inspections are performed at a slower speed than the fixed wing patrols. The ability of the helicopter to hover over the structures allows the observer to inspect the structure and other electrical components in more detail. Photographs of major defects or encroachments are taken. Observations are reported on a "by exception" basis to the Transmission Maintenance Engineer. Emergency conditions are reported directly to the System Operator. The System Operator will take the appropriate action with regard to removing facilities from service and will contact line forces to arrange for response. Helicopter inspections are conducted by Minnesota Power personnel. Observations from the inspection are recorded on audio tape and transcribed to an electronic log of the inspection.

4. Groundline Inspection and Treatment

Wood transmission lines receive a groundline inspection at 20 years of age and subsequent inspections at 10 to 15 year intervals depending on conditions found during the first and subsequent inspections. The interval between inspections generally varies with the species and original treatment of the poles. The groundline inspection includes visual observation of all structures, electrical components, and the right of way. Visual observations are reported to the Minnesota Power Transmission Maintenance Engineer on a "by exception" basis. Emergency conditions are reported directly to the System Operator. The System Operator will take the appropriate action with regard to temporarily removing facilities from service and will contact line forces to arrange for response. Information regarding the date stamp, species, original treatment, ground line circumference, height and class of pole are recorded. All poles are visually inspected and sounded to a height of approximately 8 feet with a hammer. Poles that have been in service for 20 years or more, or poles with unusual sounding, receive a more detailed inspection including groundline boring. A set of three borings is performed at the groundline to determine whether decay is occurring in the pole. Thickness of the remaining shell for all borings is reported. If internal decay is found at the groundline, the pole is partially excavated to allow additional inspection, treated with a fungicidal wrap, and backfilled. Internal

decay pockets are also treated with regulatory agency approved wood preservative and fungicide. Poles with insect damage (carpenter ants) are treated with fungicides and insecticides approved by regulatory agencies. Poles determined to have excessive decay, insect damage, or mechanical damage are red-tagged and reported as requiring replacement. Observations are documented in electronic format. A typical groundline inspection form is included in Appendix A. Groundline inspection and treatment is conducted by contract forces.

5. Climbing Inspection

Climbing inspections are conducted on wood transmission lines by Minnesota Power linemen at approximately 10 to 15 year intervals. The interval varies with the age of the line and type of materials used in construction. Linemen physically climb the wood transmission structures sounding the poles and crossarms for evidence of insect damage or decay. Guys and anchors are checked. Structure connections are tightened as necessary. Line and structure numbering placards are replaced as required. The linemen record the condition of conductor, shield wire, insulators, suspension hardware, dampers, ground wires and other electrical components. Observations are noted on hand-written inspection forms included in Appendix B. Minor repairs are accomplished at the time of inspection when possible. The completed inspection forms are submitted to the Minnesota Power Transmission Maintenance Engineer. Emergency conditions are reported directly to the System Operator. The System Operator will take the appropriate action with regard to temporarily removing facilities from service.

6. Vegetation Management

The transmission vegetation management program for SWL&P is based on a 5 year cycle. Vegetation control may include, but is not limited to, tree trimming, tree removal, and herbicide application. Herbicides are applied, with landowner permission, by certified commercial pesticide applicators. Most of the work is done by contract. Company employees who are certified arborists coordinate and review the work.

A visual inspection of the transmission line rights-of-way is done annually by helicopter to look for vegetative conditions that may create concerns to the operational integrity of the transmission system. When problems are identified, the vegetative situation is prioritized and action is taken as necessary to mitigate the vegetative problem.

C. CONDITION RATING CRITERIA

The criteria listed below establish the condition of a facility and also determine the repair schedule to correct deficiencies:

Good Condition: Maintenance is not required.

Non-critical Maintenance Required: Maintenance is done as time permits, typically completed within one year.

Urgent Maintenance Required: Maintenance process is begun as soon as the problem is reported.

D. CORRECTIVE ACTION SCHEDULE

The rating criteria as listed above determine the corrective action schedule. Budgets for minor maintenance activities are based on historical data. Major activities are generally identified a year in advance.

E. RECORD KEEPING

Inspection records will be kept for a minimum of ten years and will include inspection dates, condition rating, schedule for repair, and date of repair completion.

F. REPORTING REQUIREMENTS

A report and summary of this plan's progress will be submitted every two years. The report will consist of a letter documenting the percent of inspections achieved compared to the schedule and a description of maintenance achieved within the scheduled time allowance.

II. DISTRIBUTION

A. INSPECTION SCHEDULE AND METHODS

The various inspection schedules and methods for distribution facilities are as shown below:

INSPECTION METHOD	UNSCHEDULED	1 YEAR	4 YEARS	10 YEARS
INFORMAL	X			
VEHICLE PATROL		X		
GROUNDLINE				X
VEGETATION MANAGEMENT			X	

B. GUIDELINES

1. Introduction

SWL&P conducts regularly scheduled groundline inspections and vegetation management activities of the electrical distribution system. Informal inspections are conducted in conjunction with other utility activities. Vehicle patrol of the system is done on days with inclement weather. In general, unusual conditions observed and reported would include, but not be limited to, insufficient clearances between conductor and ground surface or between conductor and other facilities, damaged structural and electrical components, and right-of-way vegetation.

2. Informal Inspection

Informal inspections are performed by engineering, vegetation management, line department, and other utility personnel in conjunction with conducting other utility activities. Personnel are instructed to report any unusual conditions of the distribution system to the Line Crew Supervisor.

3. Vehicle Patrol

During periods of inclement weather, those portions of the distribution system accessible by vehicle are systematically patrolled by line personnel. Any unusual conditions are recorded and given to the Line Crew Supervisor.

4. Groundline Inspection and Treatment

Distribution poles receive a groundline inspection at 10 year intervals. The inspection includes visual observation of all poles and structures, electrical components, and rights-of-way. Visual observations are reported on a "by exception" basis. Information regarding the pole number, pole date, height,

class, type of pole, original groundline treatment, above ground treatment, measured groundline circumference, incising location, underbuild, extent of shell rot or other damage, and soil condition is recorded using hand held computers. All poles are visually inspected and sounded to a height of approximately 8 feet with a hammer. Poles that have been in service for 20 years or more, or poles with unusual sounding, receive a more detailed inspection including groundline boring. A set of three borings is performed at the groundline to determine whether decay is occurring in the pole. Thickness of the remaining shell for all borings is reported. If internal decay is found at the groundline, the pole is partially excavated to allow additional inspection, treated with a fungicidal wrap, and backfilled. Internal decay pockets are also treated with regulatory agency approved wood preservative and fungicide. Poles with insect damage (carpenter ants) are treated with fungicides and insecticides approved by regulatory agencies. Poles determined to have excessive decay, insect damage, or mechanical damage are red-tagged and reported as requiring replacement. Observations are documented in electronic format. Appendix C contains the specific information that is gathered. Groundline inspection and treatment is conducted by contract forces.

5. Vegetation Management

The distribution vegetation management program is based on a four year cycle. Vegetation control may include, but is not limited to, tree trimming, tree removal, and herbicide application. Herbicides are applied, with landowner permission, by certified commercial pesticide applicators. Most of the work is done by contract. Company employees who are certified arborists coordinate and review the work.

C. CONDITION RATING CRITERIA

The criteria listed below establish the condition of a facility and also determine the repair schedule to correct deficiencies:

Good Condition: Maintenance is not required.

Non-critical Maintenance Required: Maintenance is done as time permits, typically completed within one year.

Urgent Maintenance Required: Maintenance process is begun as soon as the problem is reported.

D. CORRECTIVE ACTION SCHEDULE

The rating criteria as listed above determine the corrective action schedule. Budgets for minor maintenance activities are based on historical data. Major activities are generally identified a year in advance.

E. RECORD KEEPING

Inspection records will be kept for a minimum of ten years and will include inspection dates, condition rating, schedule for repair, and date of repair completion.

F. REPORTING REQUIREMENTS

A report and summary of this plan's progress will be submitted every two years. The report will consist of a letter documenting the percent of inspections achieved compared to the schedule and a description of maintenance achieved within the scheduled time allowance.

IV. SUBSTATION

A. INSPECTION SCHEDULE AND METHODS

The various inspection schedules and methods for substation facilities are as shown below:

INSPECTION METHOD	VARIABLE	MONTHLY	BIANNUAL	1 YEAR	2 YEARS	3 YEARS	6 YEARS
SITE INSPECTION		X					
FALL BREAKER MAINTENANCE				X			
MAJOR BREAKER MAINTENANCE	X						
INFRARED				X			
BATTERY MAINTENANCE			X	X			
BATTERY LOAD TEST	X						
TRANSFORMER OIL SAMPLES				X	X		
RELAY MAINTENANCE						X	X
VEGETATION MANAGEMENT				X			

B. GUIDELINES

1. Introduction

SWL&P conducts regularly scheduled inspections of all substation facilities. At the present time, SWL&P has two 115 kV to 14 kV substations, Stinson Avenue and Winter Street and, as a result of an ongoing process of converting 4 kV facilities to 14 kV, three 14 kV to 4kV substations remain on its system. Other facilities that are regularly inspected include the company owned UW - Superior 14 kV to 4kV substation and the Murphy Oil switching station, involving two 14 kV feeders from Stinson Avenue Substation.

2. Site Inspection

Each substation is visited at least once a month and a general inspection of the facilities is conducted. Appendix D contains the forms used and the type of checks made.

3. Fall Breaker Maintenance

Each fall, the 115 kV to 14 kV substations are visited and all breakers given inspections in preparation for winter. The forms and types of inspections made are found in Appendix E.

4. Major Breaker Maintenance

Major maintenance is done on breakers at intervals that are typically six to eight years. Increased breaker operations will shorten those intervals. Appendix F contains an example of the forms used.

5. Infrared

An infrared scan of each 115 kV to 14 kV substation is done annually and Appendix G contains the form used.

6. Battery Maintenance

Battery maintenance is done during the course of the year with more in depth maintenance occurring approximately six months later. The form used is found in Appendix H.

7. Battery Load Tests

Battery load tests are done when the batteries are first installed, and then after 2, 7, 12, 17, and 20 years of age. Beyond 20 years of age, a decision is made based on past data as to the frequency of additional tests. Appendix I contains the form used.

8. Transformer Oil Samples

Annual oil samples of all 115 kV to 14 kV substation transformers are taken and analyzed by gas chromatography. Physical tests on oil samples from those transformers are done every other year.

9. Relay Maintenance

Relay maintenance involves cleaning and inspecting each relay and then testing each for proper settings. Load checks are then made after each relay is put back into service. All relays are maintained every three years with the exception of feeder relays, which have a six year cycle.

10. Vegetation Control

Vegetation is removed as necessary and maintained through the use of herbicides on a one to two year basis.

C. CONDITION RATING CRITERIA

The criteria listed below establish the condition of substation facilities and also determine the repair schedule to correct deficiencies:

Good Condition: Maintenance is not required.

Equipment Is Functional, But Has Defect: Maintenance is done as manpower is available, typically within a year.

Equipment Is Functional, But Problem Could Escalate: Maintenance is done as soon as practical, typically within 90 days.

System Flexibility Is Reduced: Maintenance is done as soon as possible, typically within a week.

Power Is Interrupted Or System Is Highly Vulnerable: Maintenance process is begun as soon as the problem is reported.

D. CORRECTIVE ACTION SCHEDULE

The rating criteria as listed above determine the corrective action schedule. Budgets for minor maintenance activities are based on historical data. Major activities are generally identified a year in advance.

E. RECORD KEEPING

Inspection records will be kept for a minimum of ten years and will include inspection dates, condition rating, schedule for repair, and date of repair completion.

F. REPORTING REQUIREMENTS

A report and summary of this plan's progress will be submitted every two years. The report will consist of a letter documenting the percent of inspections achieved compared to the schedule and a description of maintenance achieved within the scheduled time allowance.

V. APPENDICES

Appendices A through I are found on the following pages.

Atlas Sht. No.
(Distribution)

Date:

Inspector:

[illegible]

Wood Pole Groundline Inspection & Treatment Report

Inspector: _____

Date:

[illegible]

Sheet of Sheets

Appendix B
Page 17

1. POLE CODE	1. Pole Sound, No Evidence of Decay or Damage 3. Extensive Decay, Stub or Replace Within 1 Year 2. Some Evidence of Decay or Damage 4. Failure, Replace, or Stub Promptly			
2. DEFECT CODE	1. Rotted at Ground Line	4. Rotted or Split Top	7. Shell Rot	10. Fire Damage
	2. Woodpecker Holes	5. Lightning Damage	8. Hollow Heart	11. Other (Specify)
	3. Mechanical Damage	6. Leaning over 12 In.	9. Ant Damage	
3. TEST CODE	1. Sound 2. Decay (Specify in Inches of Remaining Shell)			
4.	Cross Section for #2 and #3 Above			
5. ACTION CODE	1. Replace 3. Add. Guys 5. Pole C: p 7. Ant Treatment 9. Hollow Heart Treatment 2. Stub 4. Add. Bog Shoes 6. Pole Splint 8. Straighten Str. 10. Lower Arm & Grade Top			

SYMBOLS

K - Remarks

T - Top

M - Middle

B - Bottom

L - Left

R - Right

ST - Shell Thickness

V - Void

WPH - Woodpecker Hole

X - Prompt Action Required

HT - Hardware Tightening

C - Conductor

SW - Shield Wire

Attachment C
Distribution Visual line inspection
Addition to section 4.0

DISTRIBUTION ENGINEERING AND OPERATIONS

**ADDENDUM TO SPECIFICATION OF INSPECTION OF STANDING
WOOD POLES. APPLICABLE TO DISTRIBUTION POLES.**

(REVISED 3/16/99)

4.0 VISUAL INSPECTION REQUIREMENTS

Visually inspect the above ground portion of the pole, and its attachments. Record pole number, pole owner, , pole date, , height, class, type of pole and original groundline treatment, above ground treatment, measured groundline circumference, incising location, underbuild, extent of shell rot or other damage, and soil condition in a format provided by the Purchaser.

Observe and document condition of pole top, cross arm, insulators, guys, guy protectors, ground wires, conductors, neutral wire, shield wires, bracing, nests, etc. as applicable. Note encroachments on right of way or trees in close proximity to conductors. Document conditions in a format provided by the Purchaser. **Major damage shall be reported to the Purchaser's representative immediately.**

4.1 Distribution Visual Line Inspection

4.1.1 Overhead Lines

Conductor - Note areas of fraying or damage to primary phase, primary neutral, or secondary wires. Also areas where conductor has come loose from insulators.

Line Hardware - (switches, arresters, cutouts, insulators, connectors, clamps, etc.) Check for indications of arcing, broken leads, open doors/blown fuses, loose ties

Line Equipment - (transformers, capacitor banks, regulators, reclosers) Check for indications of overheating, oil leakage, damaged bushings.

Guys and Anchors - Document missing guy protectors, grounded guys, and loose or broken guy wires.

Neutral Isolators - note location

Clearances - Document infringements as outlined in MP Overhead Distribution Construction Standards:

- 1506 Buildings
- 1507 Trees
- 1508 Fixed objects

4.1.2 Underground Lines

Cabinets, Pedestals, and Padmount Transformers (pay item)

- General condition of padmount transformers, sectionalizing pedestals (primary and secondary), translosures, and other enclosures.
- Level - report units in need of leveling
- Locks - install locks where needed (**pay item**). Report locations where locks installed.
- Oil Leaks - report units that are leaking oil to the extent that it can be detected without opening cabinets.
- Bases - report units where the base is in need of repair.
- Obstructions - report units with obstructions that would prohibit access for maintenance or repair.
- Clearances - report clearance concerns as detailed in OCDS 9420.

Riser Poles -

- Proper U-Guard installation (OCDS 9015, 9025)
- Arrester condition and lead length
- Cutout condition

4.2 Pole Ownership -

4.2.1 Record the owner of the pole.

4.2.2 If no ownership tag is present on the pole, install an oval Minnesota Power tag using this year's date nail in one end of the tag (**pay item**).

4.3 Pole Date -

4.3.1 Record the date of the pole.

4.3.2 If no date is visible on the brand, tag, or date nail, install an estimated date tag using this year's date nail to secure it to the pole (**pay item**). Estimated date tags are available in 5 year increments.

4.4 Line Clearances (**pay item**) -

4.4.1 Record line clearances from ground and ambient temperature, using "Suparule", at any road crossing locations in which the conductors appear to be less than the following heights:

- CATV, Telephone, Electrical Secondaries, and Neutrals - 18'
- Phase conductors - 20'

Establish a measurement location number on the map.

Record the ambient temperature, height to the 3 lowest conductors, type of conductor (CATV, Telephone, electric primary, secondary, or neutral) and the map location of the measurement.

4.5 Pole Attachments -

4.5.1 Identify all poles with foreign attachments (**pay item**).

4.5.2 In appropriate computer fields, record the presence of each type of attachment (CATV, CATV power supply, Telephone, electric)

Substation Inspection Report

Station STINSON 115 KV SUBSTATION

Date _____

Inspector _____

YARD - OUTSIDE the FENCE			BUILDINGS		
	O K	SEE COM		O K	SEE COM
DRIVEWAY			EXTERIOR APPEARANCE		
AREA WITHIN 10 FT OF FENCE			PADLOCKS - GATES / BUILDING		
LANDSCAPING			DOOR OPERATION		
OBSTACLE MARKING			INTERIOR LIGHTS		
FENCE			EMERGENCY SITE INFORMATION		
DANGER SIGNS			INTERIOR CLEANLINESS		
POSTS			SITE DRAWINGS		
BARBED WIRE SUPPORTS			LOG BOOK		
BARBED WIRE			TELEPHONE / TELEPHONE BOOKS		
FABRIC			FIRE EXTINGUISHER		
BOTTOM MESSENGER WIRE			TEMPERATURE (W-65 max, S-85 max)		
GAPS - LESS THAN 4 - INCHES			BATTERY ELECTROLYTE LEVELS		
GROUND - FENCE / GATE			BATTERY RACK		
VEHICLE GATE OPERATION			BATTERY AREA CLEANLINESS		
MAN GATE OPERATION			BATTERY PPE		
YARD - INSIDE the FENCE			CHARGER - VOLTS & AMPS		
NO MATERIAL STORAGE			STATION AC POWER - NORMAL		
SWITCH STICK HOLDERS			BUILDING PANELS		
SWITCH STICKS			INDICATOR LIGHTS		
EQUIPMENT SIGNAGE			REPORT RELAY TARGETS		
LANDSCAPING			REPORT ALARMS		
MANHOLES COVERED			STATION POWER WIRING		
OBSTACLES MARKED			INSULATORS and ARRESTERS		
WEEDS CONTROLLED			CONNECTIONS		

	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM
TRANSFORMERS, Power & Bus PT	Tr. #1	Tr. #2	Tr. #6	Tr. #10	115 B1 PT	115 B2 PT										
TANK PRESSURE (NOT 0 psig)																
TANK OIL LEVEL (Gauge > 25C)																
OIL TEMP. GAUGE (Temp _____)																
WINDING TEMP. GAUGE(s)																
Stage 1 Cooling (ON) (OFF) circle																
Stage 2 Cooling (ON) (OFF) circle																
BUSHING OIL LEVELS																
OIL - NO Leaks																
PAINT																
CONDITION of SLAB and STEEL																

	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM
BREAKERS, (Oil, SF-6 Gas) & Bkr. Sw's.	75L	761L	6T	115W	10TX	132L	10T	10K								
TANK SF-6 PRESSURE, OIL LEVEL																
MECH. ENERGY - Air / Springs / Motor																
CABINET & Cab. HEATER "ON"																
PAINT																
CONDITION of SLAB and STEEL																
BUSHINGS and SW. Insulators																
BUS SIDE SWITCH (All Phases Closed)																
LINE SIDE SWITCH (All Phases Closed)																

	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM	O K	SEE COM
BREAKERS, (Switchgear)	294F	1T	297F	296F	14MW	284F	292F	2T						
CUBICLE DOOR														
OPERATING SPRINGS "Charged"														
CABINET HEATER "ON"														

Use the back of sheet for comments.

Substation Inspection Report

Station WINTER STREET
 Date _____ Time _____ Temp. _____
 Inspector _____

YARD - OUTSIDE the FENCE		O K	SEE COM.	BUILDINGS		O K	SEE COM.
1	DRIVEWAY			23	EXTERIOR APPEARANCE		
2	AREA WITHIN 10 FT OF FENCE			24	PADLOCKS - GATES / BUILDING		
3	LANDSCAPING			25	DOOR OPERATION		
4	OBSTACLE MARKING			26	INTERIOR LIGHTS		
FENCE				27	EMERGENCY SITE INFORMATION		
5	DANGER SIGNS			28	INTERIOR CLEANLINESS		
6	POSTS			29	SITE DRAWINGS		
7	BARBED WIRE SUPPORTS			30	LOG BOOK		
8	BARBED WIRE			31	TELEPHONE / TELEPHONE BOOKS		
9	FABRIC			32	FIRE EXTINGUISHER		
10	BOTTOM MESSENGER WIRE			33	TEMPERATURE (W-65 max, S-85 max)		
11	GAPS - LESS THAN 4 - INCHES			34	BATTERY ELECTROLYTE LEVELS		
12	GROUND - FENCE / GATE			35	BATTERY RACK		
13	VEHICLE GATE OPERATION			36	BATTERY AREA CLEANLINESS		
14	MAN GATE OPERATION			37	BATTERY PPE		
YARD - INSIDE the FENCE				38	CHARGER - VOLTS & AMPS		
15	NO MATERIAL STORAGE			39	STATION AC POWER - NORMAL		
16	SWITCH STICK HOLDERS			BUILDING PANELS			
17	SWITCH STICKS			40	INDICATOR LIGHTS		
18	EQUIPMENT SIGNAGE			41	REPORT RELAY TARGETS		
19	LANDSCAPING			42	REPORT ALARMS		
20	MANHOLES COVERED			STATION POWER WIRING			
21	OBSTACLES MARKED			43	INSULATORS and ARRESTERS		
22	WEEDS CONTROLLED			44	CONNECTIONS		

	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.
TRANSFORMERS, Power & Bus PT								
TANK PRESSURE (NOT 0 psig)								
TANK OIL LEVEL (Gauge > 25C)								
OIL TEMP. GAUGE (Temp _____)								
WINDING TEMP. GAUGE(s)								
Stage 1 Cooling (ON) (OFF) circle								
Stage 2 Cooling (ON) (OFF) circle								
BUSHING OIL LEVELS								
OIL - NO Leaks								
PAINT								
CONDITION of SLAB and STEEL								

	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.
BREAKERS, (SF-6 Gas) & Bkr. Sw's.														
TANK SF-6 PRESSURE														
MECH. ENERGY - Air / Springs / Motor														
CABINET & Cab. HEATER "ON"														
PAINT														
CONDITION of SLAB and STEEL														
BUSHINGS and SW. Insulators														
BUS SIDE SWITCH (All Phases Closed)														
LINE SIDE SWITCH (All Phases Closed)														

	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.	O K	SEE COM.
BREAKERS, (Switchgear)														
CUBICLE DOOR														
OPERATING SPRINGS "Charged"														
CABINET HEATER "ON"														
PAINT														

28th ST SUBSTATION WEEKLY REPORT

DATE _____

PHASE	MAX TRANSF. TEMP.	REGULATOR POSITION INDICATOR		VOLTS	AMPS	O.C.B. COUNTER READING	BATTERY SPECIFIC GRAVITY	FUSES INSPECTED
		LOWER	RAISE					
A								
B								
C								

REMARKS _____

READ BY _____

WHY Reading _____ X10 _____

PEAR _____ X10 _____

EAST END SUBSTATION WEEKLY REPORT

DATE _____

PHASE	MAX. TRANSF. TEMP	5 Feeder	9 Feeder
		G.C.B. COUNTER READING	O.C.B. COUNTER READING
A			
B			
C			

PEAK KW _____ X 10 = _____
 TIME READING _____
 X 10 _____

Number 5 Feeder

PHASE	REGULATOR POSITION INDICATOR		IND. VOLTS	MAX. AMPS X 60	REMARKS
	Lower	Raise			
A					
B					
C					

Number 9 Feeder

PHASE	REGULATOR POSITION INDICATOR		IND. VOLTS	MAX. AMPS X 60	REMARKS
	Lower	Raise			
A					
B					
C					

READ BY _____

Appendix D

OAKES AVENUE SUBSTATION

DATE _____

MAX. TRANSF. TEMP.			REGULATOR POS. INDICATOR						VOLTMETER READING			OIL CIRCUIT RECLOSER COUNTER READING						
			A	E	C	FINDER NO. 7						FINDER NO. 8						
1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

READ BY _____

WISCONSIN STATE UNIVERSITY

DATE _____

REG		IND VOLTS			MAX AMPS (x8C)			Trans Temp
L	R	A	B	C	A	B	C	

REMARKS _____

Read by: _____

Murphy Oil Substation

Date:

Read By:

Vacuum Pac Pressure ____ PSI

Hydraulic Pressure ____ PSI

Switch Position 294 F OPEN CLOSED 299 F OPEN CLOSED

Station Service OK FAIL

Temperature ____ Degrees

REMARKS:

Area **C**

Site

STINSON AVE. 115KV SUBSubstationCode **STN**

Fall Breaker Inspection Procedures

1. Check compressor oil level. (Fill if necessary)
2. Check motor, belts, pullys, and guards. (Replace or repair as required)
3. Check thermostat and heater(s). (make sure all work or repair as required)
4. Check hydraulic or pneumatic systems for leaks. (Repair problems)
5. Check interrupter compartment oil level or SF-6 gas. (add if low)
6. Check control wiring connections for tightness. (tighten loose connections)
7. Check operation counter. (make sure it is working)
8. Check AC and DC circuit fuses. (clean contact ends or if old looking - replace)

15 KV	Breaker	14MW	MtceNo	B 904	
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo	0288A4254-005
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle	
Technician(s)				Date Completed	

15 KV	Breaker	1T	MtceNo	B 905	
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo	0288A4254-002
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle	
Technician(s)				Date Completed	

15 KV	Breaker	284F	MtceNo	B 906	
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo	0288A4254-007
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle	
Technician(s)				Date Completed	

15 KV	Breaker	292FM	MtceNo	B 907	
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo	0288A4254-006
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle	
Technician(s)				Date Completed	

15 KV	Breaker	297FM	MtceNo	B 908
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo 0288A4254-003
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle
Technician(s)			Date Completed	

15 KV	Breaker	296FM	MtceNo	B 909
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo 0288A4254-001
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle
Technician(s)			Date Completed	

15 KV	Breaker	294FM	MtceNo	B 910
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo 0288A4254-004
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle
Technician(s)			Date Completed	

15 KV	Breaker	2T	MtceNo	B 911
Manufacture	GENERAL ELECTRIC	Model	VVC-13.8-750-OH	SerialNo 0288A4254-008
Style	Vacuum	Mechanism	ML-13C (SPRING)	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	10K	MtceNo	B 866
Manufacture	MITSUBISHI	Model	100-SFMT-40HE	SerialNo 950200101
Style	SF-6	Mechanism	BM-1	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	10T	MtceNo	B 672
Manufacture	SIEMENS	Model	BZO-121-40-6C	SerialNo 42162-1
Style	Oil	Mechanism	PH-33T-6	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	10TX	MtceNo	B 673
Manufacture	SIEMENS	Model	BZO-121-40-6C	SerialNo 42162-2
Style	Oil	Mechanism	PH-33T-6	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	115W	MtceNo	B 202
Manufacture	WESTINGHOUSE	Model	121-GM-20	SerialNo 1-38Y4127
Style	Oil	Mechanism	AA-10-60	MechanismStyle MotorWoundSpring
Technician(s)			Date Completed	

115 KV	Breaker	132L	MtceNo	B 674
Manufacture	SIEMENS	Model	BZO-121-40-6C	SerialNo 42162-3
Style	Oil	Mechanism	PH-33T-6	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	6T	MtceNo	B 387
Manufacture	WESTINGHOUSE	Model	1150-GM-5000	SerialNo 1-38Y3772
Style	Oil	Mechanism	AA-10-60	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	75L	MtceNo	B 383
Manufacture	WESTINGHOUSE	Model	1150-GM-5000	SerialNo 1-38Y2430
Style	Oil	Mechanism	AA-10-60	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	761L	MtceNo	B 384
Manufacture	WESTINGHOUSE	Model	1150-GM-5000	SerialNo 1-38Y2431
Style	Oil	Mechanism	AA-10-60	MechanismStyle
Technician(s)			Date Completed	

Area **C**

Site

WINTER 115KV SUBSubstationCode **WTR**

Fall Breaker Inspection Procedures

1. Check compressor oil level. (Fill if necessary)
2. Check motor, belts, pullys, and guards. (Replace or repair as required)
3. Check thermostat and heater(s). (make sure all work or repair as required)
4. Check hydraulic or pneumatic systems for leaks. (Repair problems)
5. Check Interrupter compartment oil level or SF-6 gas. (add if low)
6. Check control wiring connections for tightness. (tighten loose connections)
7. Check operation counter. (make sure it is working)
8. Check AC and DC circuit fuses. (clean contact ends or if old looking - replace)

15 KV	Breaker	14MW	MtceNo	B 951	
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo	25Y9531B2 S#745
Style	Air	Mechanism	DH-P SPRING	MechanismStyle	
Technician(s)			Date Completed		

15 KV	Breaker	1T	MtceNo	B 952	
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo	25Y9531B2 S#1
Style	Air	Mechanism	DH-P SPRING	MechanismStyle	
Technician(s)			Date Completed		

15 KV	Breaker	286F	MtceNo	B 953	
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo	25Y9531B1 S#1
Style	Air	Mechanism	DH-P SPRING	MechanismStyle	
Technician(s)			Date Completed		

15 KV	Breaker	290F	MtceNo	B 976	
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo	6910716G02 S#664
Style	Air	Mechanism	DH-P SPRING	MechanismStyle	
Technician(s)			Date Completed		

15 KV	Breaker	295F	MtceNo	B 977
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo 6910716G02 S#663
Style	Air	Mechanism	DH-P SPRING	MechanismStyle
Technician(s)			Date Completed	

15 KV	Breaker	298F	MtceNo	B 954
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo 25Y9531B1 S#1
Style	Air	Mechanism	DH-P SPRING	MechanismStyle
Technician(s)			Date Completed	

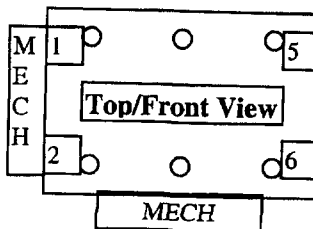
15 KV	Breaker	299F	MtceNo	B 955
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo 25Y9531B1 S#4
Style	Air	Mechanism	DH-P SPRING	MechanismStyle
Technician(s)			Date Completed	

15 KV	Breaker	2T	MtceNo	B 978
Manufacture	WESTINGHOUSE	Model	150-DHP-500	SerialNo 6910716G11 S#744
Style	Air	Mechanism	DH-P SPRING	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	75-76MW	MtceNo	B 734
Manufacture	HIGH VOLTAGE BREAKER	Model	HVB-121-40000	SerialNo H121A2058-202
Style	SF-6	Mechanism	HVB AIR-OPEN	MechanismStyle
Technician(s)			Date Completed	

115 KV	Breaker	75L	MtceNo	B 618
Manufacture	GOULD-BOVERI	Model	121PA40-20	SerialNo 41-3928-1
Style	SF-6	Mechanism	ELK-02	MechanismStyle
Technician(s)			Date Completed	

INSPECTION AND MTCE REPORT



OIL BREAKER

LOCATION _____ MAINT # _____
BREAKER _____ DATE _____
MANUFACTURER _____ TEMPERATURE _____ F
TYPE _____ VOLTAGE _____ kV WEATHER _____
SERIAL # _____ AMPS _____ WIND _____
INSPECTORS _____
TYPE OF INSP. _____
DIRECTION _____ MPH
HUMIDITY _____
BREAKER OPERATION COUNTER
BEFORE _____
AFTER _____
Panel Breaker

MICRO OHM TEST: (u - micro = .000001) (m - milli = .001)
MANUFACTURERS RECOMMENDED MICRO OHMS LESS THAN _____ u OHMS
TEST SET _____ CATALOG # _____ SERIAL # _____
SWITCH SETTINGS _____ OHMS _____
100 AMPS
Before Cleaning 1 BUSHING 2 3 BUSHING 4 5 BUSHING 6
After Cleaning _____
Micro Ohms Micro Ohms Micro Ohms

MEGGAR TEST:

(1000+)

MEASUREMENT IN MEG OHMS TO GROUND WITH BREAKER CLOSED
1 BUSHING 2 3 BUSHING 4 5 BUSHING 6
Meg Ohms Meg Ohms Meg Ohms

GENERAL CONDITION OF BREAKER EXTERIOR:

	1	2	3	4	5	6
BUSHING H.V. CONNECTIONS						
BUSHING OIL LEVEL						
BUSHING PORCELAIN						
BUSHING CLEANLINESS						
BUSHING ANCHOR BOLTS						
TANK EXTERIORS						
TANK OIL VALVES/VENTS						
SLAB/STAND						
BREAKER ANCHOR BOLTS						
GROUNDS-CLEAN/TIGHTEN						

AIR STORAGE TANK:

NAMEPLATE _____

PAINT _____

SEALS/INSP. COVER BOLTS _____

DRAIN TANK MOISTURE _____

VALVE OPERATION CONDITION _____

(Not if Temp Below 40 Deg F) _____

MECHANISM/CONTROL CABINET:

MECHANISM NAMEPLATE _____

OPENING ENERGY _____

CLOSING ENERGY _____

GENERAL APPEARANCE _____

TRIP COIL APPEARANCE _____

CLOSE COIL

APPEARANCE _____

TRIP COIL OPERATION _____

CLOSE COIL OPERATION _____

SPRING CHARGING MOTOR MECHANISM _____

MECHANISM LINKAGE _____

ELECTRICAL /WIRING _____

LIMIT/OTHER SWITCHES _____

NUTS, BOLTS, SCREWS, ETC. _____

HEATERS/THERMOSTATS _____

AUXILLARY RELAYS _____

AUXILLARY SWITCH CONTACTS _____

LUBE AUXILLARY SWITCH LINKAGE _____

LUBE CLOSE & TRIP LATCH _____

LUBE OPERATING LINKAGE/CHAIN _____

AIR, GAS, OIL LEAKS _____

COMMENTS: _____

AIR COMPRESSOR:

NAMEPLATE _____

HOUR METER _____

AS FOUND _____

HOURS _____

AS LEFT _____

HOURS _____

AIR PRESSURE _____

AS FOUND _____

PSIG _____

AS LEFT _____

PSIG _____

PUMP UP TIME _____

FROM 0 PSIG

MIN.

FROM LOCKOUT

MIN.

FROM GOVERNOR

MIN.

Less than 60 Min.

Less than 15 Min.

Less than 10 Min.

CRANKCASE OIL LEVEL _____

FULL _____

CHANGE _____

ADD _____

(Add when 1/2" Below Full)

BELTS _____

GUARDS _____

LINES/FITTINGS _____

AIR FILTER _____

NUTS, BOLTS, ETC _____

HEATER/THERMOSTAT _____

COMMENTS _____

AIR COMPRESSOR MOTOR:

NAMEPLATE

MOTOR ALLIGNMENT

BEARING LUBRICATION

COMMENTS:

AIR COMPRESSOR PRESSURE SWITCH OPERATION:

		ON	AS FOUND	OFF	ON	AS LEFT	OFF
GOVERNOR	63 G	_____	_____	_____	_____	_____	_____
PSIG							
LOW PRESSURE ALARM	63 AL	_____	_____	_____	_____	_____	_____
PSIG							
LOCKOUT	63 LO	_____	_____	_____	_____	_____	_____
PSIG							
COMMENTS							

NUMBER OF CLOSE/OPEN OPERATIONS TO LOCKOUT WITH AIR COMPRESSOR OFF

ACCUMULATOR:

PRECHARGE AT "0" DEG F

BEFORE

AFTER

TANK OIL LEVEL: 1 BUSHING 2 3 BUSHING 4 5 BUSHING 6

HIGH, OK, LOW

OIL WAS: FILTERED _____ REPLACED _____ TOTAL GALLONS _____

OIL DIELECTRIC TEST :

MEASUREMENT IN KV 1 BUSHING 2 3 BUSHING 4 5 BUSHING 6

BEFORE

FILTERING/REPLACING

AFTER

FILTERING/REPLACING

OIL CONDITION : (AS FOUND)

AMOUNT OF CARBON 1 BUSHING 2 3 BUSHING 4 5 BUSHING 6

NONE, LIGHT, MEDIUM, HEAVY

GENERAL COMMENTS: OK, Good, Fair, Poor, Tight, Tightened, Lubed with XXXXX, Cleaned with XXXXX, Adjusted with XXXXX, Filled with XXXXX, Burnished, Replaced, Replaced with XXXXX.

CENTRAL AREA

Annual Infrared Scans

	SITES	DATE COMPLETED	TECHNICIAN(S) INITIALS	COMMENTS
1	ARROWHEAD 230/115 KV			
2	ARROWHEAD DC TERMINAL			
3	MIDWAY ROAD 115/24 KV			
4	HILLTOP 230/115 KV			
5	DULUTH 4TH AVE. WEST 14/4 KV			
6	DULUTH 2ND AVE. EAST 14/4 KV			
7	DULUTH 15TH AVE. WEST 115/14 KV			
8	15TH REGULATORS			
9	M.L. HIBBARD SE 115 KV			
10	LAKE SUPERIOR PAPER 115/14 KV			
11	GARY 115/14 KV			
12	COLBYVILLE 115/14 KV			
13	RIDGEVIEW 115/14 KV			
14	DULUTH 9TH AVE. EAST 14/4 KV			
15	CRESCENT VIEW 14/4 KV			
16	PARK POINT 14/4 KV			
17	WDIO REGULATORS			
18	HAINES ROAD 115/14 KV			
19	POTLATCH 115 KV			
20	CLOQUET 115 KV			
21	CLOQUET MOORHEAD ROAD 23/4 KV			
22	WRENSHALL 115/14 KV			
23	CARLTON WEST 23/4 KV			
24	SAWYER 23/7 KV			
25	KNIFE FALLS HE STA. 2/14 KV			
26	SCANLON HE STA. 2/14/23 KV			
27	FOUR CORNERS 115/69 KV - UPA			
28	FLOODWOOD 115/14 KV			
29	MEADOWLANDS 115/14 KV			
30	BURNETT 115/14 KV			
31	MAHTOWA VILLAGE 48/23/12 KV			
32	MAHTOWA 115/23 KV			
33	BARNUM 48/12 KV			
34	ANDERSONS CORNER 48/12 KV			
35	SANDSTONE 68/46/22 KV			
36	HINCKLEY WEST 48/12 KV			
37	HINCKLEY EAST 69/48/12 KV			
38	FONDULAC HE STA. 115 KV			
39	DENHAM 48/23/12 KV			
40	ASKOV 48/12 KV			
41	KERRICK 48/4 KV			
42	MILITARY ROAD 48/14 KV			
43	WRENSHALL RIVERSIDE			
44	THOMSON HE STA. 115/46/14 KV			
45	STINSON 161/115/14 KV			
46	WINTER STREET 115/14 KV			
47	RADISSON NETWORK SUB 14/ 480 KV			
48	KDAL NETWORK SUB 14/ 480 KV			
49	YMCA NETWORK SUB 14/ 480 KV			
50	FRENCH RIVER 115/14 KV			
51	TWO HARBORS 115/14 KV			
52	SILVER BAY HILLSIDE 115/14 KV			
53	SILVER BAY TOWNSITE 14/4 KV			
54	TACONITE HARBOR 138/115 KV			

INSPECTOR (S) _____

Date _____

Station / Location _____

Battery Manufacturer _____

Battery ID No. _____

Cell Model or Catalog No. _____

Battery Voltage _____

of Cells _____

Full Charge Specific Gravity _____

Connection Torque Value _____

INCH Pounds

Inspection ☐

Quarterly (voltages, sp. gravity, visual, acid level, & equalize)

☐

Yearly (voltages, sp. gravity, micro-ohms, torque, visual, acid level, & equalize)

☐

LOAD Test (voltages, sp. gravity, micro-ohms, torque, visual, acid level, & equalize)

Date Battery Installed _____

NOTE: All readings are to be taken with the **BATTERY on FLOAT**. Do **NOT** add water before taking readings

Battery Float Voltage _____

+ to GRD _____

- TO GRD _____

Charger Amps _____

Room Temperature _____

Pilot Cell Temperature(s) _____

Battery Float Voltage

+ to GRD

- TO GRD

Charger Amps

Room Temperature

(Take ALL voltage readings at battery terminals)

(on float)

Pilot Cell Temperature(s)

Cell	VOLTS	SPECIFIC GRAVITY	Cell Connection	MICRO OHMS	Cell	VOLTS	SPECIFIC GRAVITY	Cell Connection	MICRO OHMS
1	2.	1.	1 - 2		31	2.	1.	31 - 32	
2	2.	1.	2 - 3		32	2.	1.	32 - 33	
3	2.	1.	3 - 4		33	2.	1.	33 - 34	
4	2.	1.	4 - 5		34	2.	1.	34 - 35	
5	2.	1.	5 - 6		35	2.	1.	35 - 36	
6	2.	1.	6 - 7		36	2.	1.	36 - 37	
7	2.	1.	7 - 8		37	2.	1.	37 - 38	
8	2.	1.	8 - 9		38	2.	1.	38 - 39	
9	2.	1.	9 - 10		39	2.	1.	39 - 40	
10	2.	1.	10 - 11		40	2.	1.	40 - 41	
11	2.	1.	11 - 12		41	2.	1.	41 - 42	
12	2.	1.	12 - 13		42	2.	1.	42 - 43	
13	2.	1.	13 - 14		43	2.	1.	43 - 44	
14	2.	1.	14 - 15		44	2.	1.	44 - 45	
15	2.	1.	15 - 16		45	2.	1.	45 - 46	
16	2.	1.	16 - 17		46	2.	1.	46 - 47	
17	2.	1.	17 - 18		47	2.	1.	47 - 48	
18	2.	1.	18 - 19		48	2.	1.	48 - 49	
19	2.	1.	19 - 20		49	2.	1.	49 - 50	
20	2.	1.	20 - 21		50	2.	1.	50 - 51	
21	2.	1.	21 - 22		51	2.	1.	51 - 52	
22	2.	1.	22 - 23		52	2.	1.	52 - 53	
23	2.	1.	23 - 24		53	2.	1.	53 - 54	
24	2.	1.	24 - 25		54	2.	1.	54 - 55	
25	2.	1.	25 - 26		55	2.	1.	55 - 56	
26	2.	1.	26 - 27		56	2.	1.	56 - 57	
27	2.	1.	27 - 28		57	2.	1.	57 - 58	
28	2.	1.	28 - 29		58	2.	1.	58 - 59	
29	2.	1.	29 - 30		59	2.	1.	59 - 60	
30	2.	1.	30 - 31		60	2.	1.		

Voltage Range

 High Low Diff.

 If Diff. MORE than 0.10
 or Low is below 2.13 volts,
 Then Equalize for 72 Hrs.

Specific Gravity Range

 High Low Average

 If High or Low EXCEED
0.010 From Average,
 Then Equalize for 72 Hrs.
TORQUE

CHECK and SET Torque on bolts & nuts of ALL intracell connectors and leads.

VISUAL INSPECTION

YES NO

EXTERNAL INSPECTION

- ____ Battery rack in good condition. (free from corrosion, plastic on rails, solid-no wobbles)
____ All Cell Jars in good condition. (no cracks, scratches, leaky top seals, etc.)
____ All Posts and Intracell connectors free from corrosion. (clean or replace problems)
____ All Terminal post seals OK. (no electrolyte found around + or - posts)
____ All Cell Tops free of dirt, grease and debris. (clean & comment on problem cells)
____ All Cell Tops free of Electrolyte, or other Liquids. (clean & comment on problem cells)

YES NO

INTERNAL INSPECTION

(use flashlight for these inspections)

- ____ Cell Electrolyte is discolored or cloudy. (indicates contamination)
____ Cell Bottoms contain Sediment. (comment on cells & amount)
____ Cell Positive (dark brown) plates are warped or bending. (indicates + plate growth)
____ Cell Positive plates are cracking, or breaking. (indicates excessive + plate growth)
____ Cell Negative (light gray) plates are warped, or bending. (indicates plate growth)
____ Cell Plate Separators are bending. (indicates plate growth)
____ Cell Positive plates sparkle under flashlight. (indicates Sulfation)
____ Sides or edges of plates show ghostly white/gray webs. (indicates Hydration)
____ Top of plates and plate connectors have Sediment on them. (indicates Mossing)

COMMENTS Identify cell(s), indicate problem(s) found, and corrective action(s) taken.

ACID LEVEL INSPECTION

ADDITION of WATER should be performed just before leaving site or just before equalizing.

Amount of DISTILLED WATER _____ Gals. Qts. Pts.
added to entire battery. (circle one)

(identify cells below low level mark)

EQUALIZE

(LAST - if required, - always for minimum of 72 hours after load testing, some batteries may need extended times depending on condition)

- ☐ YES BATTERY PLACED ON EQUALIZE FOR _____ UPON COMPLETION OF MAINTENANCE
☐ NO BATTERY DOES NOT REQUIRE AN EQUALIZE CHARGE AT THIS TIME

Battery Equalize Voltage _____

TEST EQUIPMENT USED DURING THIS MAINTENANCE

VOLTMETER _____

MICRO-OHM METER _____

HYDROMETER _____

TORQUE WRENCH _____

STORAGE BATTERY AND CHARGER EQUIPMENT DATA

Division: **SWL**

Site / Facility

STINSON 115KV SUBSTATION (SWGR BLDG)

M. P. Application **#1 SUBSTATION**

Battery I. D. **1192**

130 VOLT BATTERY INFORMATION

Manufacture	VARTA	Date Installed	1/1/85
Type of Pos. Plate	SELENIUM	M. P. Purchase Order #	
Model or Catalog#	VB428	Battery E. R. #	1741-7205
8 hr. Capacity to 1.75 vpc	214	UNIT Shipping Weight	2.2
Battery Voltage Rating	130	UNIT Weight FILLED	2.2
Number of Cells	60	Electrolyte Per CELL	9.5
Number of Units	30	UNIT Size L / W / H	248/229/330
1 min Dschg to 1.75 vpc	480	Rack Dim. L / W / H	81/213
15 min Dschg to 1.75 vpc	294.8	Battery Fuse Rating	400

Battery MAINTENANCE Information

Specific Gravity	1.240	Connection Torque	66	Inch - LBs
Cell FLOAT Voltage	2.23	Battery FLOAT Voltage	133.8	Volts DC
Cell EQUALIZE Voltage	2.35	Battery EQUALIZE Voltage	141	Volts DC
		Connection Micro Ohms	200	Maximum

Charger Information

Charger Manufacture	LaMarche	Date Installed	
Catalog #	A11-30-130V	Serial #	B60040
DC Output Voltage	130	DC VOLTS	
DC Output Amperes	25	AMPS DC	
AC Input Voltage	120/208/240	AC VOLTS	
		Charger Weight (lbs)	
		Purchase Order #	
		Charger Install E. R.	

Battery Load Test Information

Final Battery Voltage	Load Test Duration	Load Test Current at 77 Deg. F	Final Cell Voltage
108	60	132.6	1.8
Volts DC	Minutes	Amps	Volts DC

Results of the LAST Load Test

3/9/99

108 O K Battery Voltage Limit	108.2 END of TEST BATT. Voltage	8 TOTAL # of Failed Cells	060:00 min : sec Under Load	118 Actual Test Load	1.110 Correction Factor	60 F Battery Temp.	133 Amps 77 Deg. Load	1.8 V /Cell Last Test
100.00% % Capacity			100% RETEST IN 5YRS Status / Recommendation					

COMMENTS

Load test schedule : New, 2yrs, 7yrs, 12yrs, 17yrs, 20yrs.
 TWO CELLS PER CASE - CANNOT SEE INTO CASE TO OBSERVE PLATES -
 MUST MONITOR VOLTAGE FROM TWO CELLS DURING LOAD TEST 1.79 / 3.58
 08 yrs test results (09/15/93): 122 amps @ 64 F for 60:00 min to 1.80 vpc, final voltage 108.1 = 100%
 14 yrs test results (03/09/99): 118 amps @ 60 F for 60:00 min to 1.80 vpc, final voltage 108.2 = 100%

STORAGE BATTERY AND CHARGER EQUIPMENT DATA

Division: **SWL**

Site / Facility

STINSON 115KV SUBSTATION (CONT.HSE.)

M. P. Application #1 SUBSTATION

Battery I. D. **1191**

130 VOLT BATTERY INFORMATION

Manufacture	GNB	Date Installed	3/1/87
Type of Pos. Plate	CALCIUM	M. P. Purchase Order #	86-08429
Model or Catalog#	2MCX-7	Battery E. R. #	1741-7181
8 hr. Capacity to 1.75 vpc	255	UNIT Shipping Weight	2.2
Battery Voltage Rating	130	UNIT Weight FILLED	2.2
Number of Cells	58	Electrolyte Per CELL	5.5
Number of Units	29	UNIT Size L / W / H	12.4/20.4/40.5
1 min Dschg to 1.75 vpc	339	Rack Dim. L / W / H	426.7/55.9
15 min Dschg to 1.75 vpc	231	Battery Fuse Rating	350

Battery MAINTENANCE Information

Specific Gravity	1.215	Connection Torque	100	Inch - LBs
Cell FLOAT Voltage	2.25	Battery FLOAT Voltage	130.5	Volts DC
Cell EQUALIZE Voltage	2.33	Battery EQUALIZE Voltage	135.14	Volts DC
		Connection Micro Ohms	175	Maximum

Charger Information

Charger Manufacture	RATELCO	Date Installed	3/1/87
Catalog #	ARE 130 CE25	Serial #	NA
DC Output Voltage	130	DC VOLTS	
DC Output Amperes	25	AMPS DC	
AC Input Voltage	120/208/240	AC VOLTS	
		Charger Weight (lbs)	0
		Purchase Order #	86-08434
		Charger Install E. R.	1741-7181

Battery Load Test Information

Final Battery Voltage	Load Test Duration	Load Test Current at 77 Deg. F	Final Cell Voltage
101.5	60	128	1.75
Volts DC	Minutes	Amps	Volts DC

Results of the LAST Load Test

10/13/99

101.5	104.5	0	060:00	120	1.064	67 F	128 Amps	1.75
OK Battery Voltage Limit	END OF TEST BATT. Voltage	TOTAL # of Failed Cells	min : sec Under Load	Actual Test Load	Correction Factor	Battery Temp.	77 Deg. Load	V /Cell Last Test
100.00%				100% RETEST IN 5YRS				
% Capacity				Status / Recommendation				

COMMENTS

Load test schedule : New, 2yrs, 7yrs, 12yrs, 17yrs, 20yrs.
 02 yrs test results (??/??/87): ??? amps @ ?? F for 60 min to 1.75 vpc, final voltage ??? = 100%
 06 yrs test results (09/16/93): 119 amps @ 66 F for 60 min to 1.75 vpc, final voltage 104.3 = 100%
 12 yrs test results (10/13/99): 120 amps @ 67 F for 60 min to 1.75 vpc, final voltage 104.5 = 100%

STORAGE BATTERY AND CHARGER EQUIPMENT DATA

Division: **SWL**

Site / Facility

WINTER 115KV SUBSTATION

M. P. Application **#1 SUBSTATION**

Battery I. D. **1193**

130 VOLT BATTERY INFORMATION

Manufacture	VARTA/SALAMA	Date Installed	1/1/92
Type of Pos. Plate	SELENIUM	M. P. Purchase Order #	91-05813-G-JR
Model or Catalog#	3SR 21ELS	Battery E. R. #	741-7305
8 hr. Capacity to 1.75 vpc	150	UNIT Shipping Weight	40.0 lbs
Battery Voltage Rating	130	UNIT Weight FILLED	40.0 lbs
Number of Cells	58	Electrolyte Per CELL	1.06 gals
Number of Units	58	UNIT Size L / W / H	4.06"/8.11"/15.63"
1 min Dschg to 1.75 vpc	213.6	Rack Dim. L / W / H	
15 min Dschg to 1.75 vpc	150.2	Battery Fuse Rating	200

Battery MAINTENANCE Information

Specific Gravity	1.240	Connection Torque	135	Inch - LBs
Cell FLOAT Voltage	2.23	Battery FLOAT Voltage	129.34	Volts DC
Cell EQUALIZE Voltage	2.35	Battery EQUALIZE Voltage	136.3	Volts DC
		Connection Micro Ohms	100	Maximum

Charger Information

Charger Manufacture	LAMARCHE	Date Installed	1/1/92
Catalog #	A12B-25-130-B1	Serial #	K-1885-4
DC Output Voltage	130	DC VOLTS	
DC Output Amperes	25	AMPS DC	
AC Input Voltage	240	AC VOLTS	
		Charger Weight (lbs)	
		Purchase Order #	91-05814-G-JR
		Charger Install E. R.	741-7305

Battery Load Test Information

Final Battery Voltage	Load Test Duration	Load Test Current at 77 Deg. F	Final Cell Voltage
104.4	60	73.9	1.8
Volts DC	Minutes	Amps	Volts DC

Results of the LAST Load Test

12/8/99

104.4	106.6	0	060:00	66	1.110	60 F	74 Amps	1.8
O K Battery Voltage Limit	END of TEST BATT. Voltage	TOTAL # of Failed Cells	min : sec Under Load	Actual Test Load	Correction Factor	Battery Temp.	77 Deg. Load	V /Cell Last Test
100.00%				100% RETEST IN 5YRS				
% Capacity				Status / Recommendation				

COMMENTS

Load test schedule : New, 2yrs, 7yrs, 12yrs, 17yrs, 20yrs.

This test was to determine capacity after being installed for two years

02 yrs test results (05/24/94): 071 amps @ 71 F for 60:00 min to 1.80 vpc, final voltage 104.8 = 100%

07 yrs test results (12/08/99): 066 amps @ 60 F for 60:00 min to 1.80 vpc, final voltage 106.6 = 100%